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## Chalcolithic/Early Bronze Age Flint Mines in the Northern Badia

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## CHALCOLITHIC/EARLY BRONZE AGE FLINT MINES IN THE NORTHERN BADIA

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**Résumé** – Les mines de production d'éclats corticaux destinés à la confection d'outils en silex spécifiques (racloirs tabulaires, racloirs en éventail, industrie d'al-Jafr) sont connues dans le bassin d'al-Jafr, dans le sud-est de la Jordanie, depuis les années 1990. En 2000, des mines de production comparables ont été identifiées dans le nord-est de la Jordanie et ont fait l'objet d'une étude plus approfondie à partir de 2010. Cet article traite des caractéristiques de l'emplacement de ces ressources minérales ainsi que des modalités d'acquisition de la matière première dans ces mines. Enfin, les hypothèses sur le contexte socio-économique dans lequel s'intègre cette production seront évoquées.

**Mots-clés** – Extraction du silex, Chalcolithique/Bronze ancien, production d'outils sur éclats corticaux, industrie lithique, Badia jordanienne.

**Abstract** – Since the late 1990s, flintmines where cortical tool blanks (tabular scrapers, fan scrapers, Jafr tools) were produced in large numbers, are known from the Jafr region in SE Jordan. In 2000 a comparable mining region was discovered in NE Jordan, which has been under closer investigation since 2010. This paper will discuss the characteristics of the location of these resources and the manners of raw material procural. Finally, the socioeconomic background will be hypothetically addressed.

**Key-Words** – Flintmining, Chalcolithic/Early Bronze Age, Cortical tool production, Lithic Technology, Jordan Badia.

**ملخص** – عرفت منطقة الجفر منذ نهاية التسعينيات بمناجم الصوان التي أنتجت القطع الصوانية ذات القشرة الكلسية (المكاشط المسطحة، المكاشط المروحية، وادوات الجفر) والتي أنتجت بكميات كبيرة. وفي عام ٢٠٠٠ تم اكتشاف منطقة مشابهة في شمال شرق الأردن والتي ما زالت تحت الدراسة منذ عام ٢٠١٠. وتناقش هذه الورقة خصائص هذه المنطقة الجديدة واستخراج المواد الخام منها. وأخيرا، سيتم مناقشة الخلفية الاجتماعية والاقتصادية المحتملة.

**كلمات محورية** – مناجم صوان، عصر الحجري النحاسي/عصر البرونزي المبكر، قطع صوانية ذات قشرة كلسية، تكنولوجيا حجرية، بادية الأردن.

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## INTRODUCTION

Cortical scrapers, also known as “fan scrapers”, “tabular scrapers” or “Jafr tools”, are *fossiles directeurs* of the Chalcolithic and Early Bronze Age period in Southwest Asia. Their appearance in archaeological contexts covers a region ranging from Egypt, across the entire Levant and Transjordan, the regions of the Middle Euphrates and southern Anatolia, to the Susiana Plain <sup>2</sup>. It seems even possible that such tools were also used in southern Mesopotamia <sup>3</sup>.

Their abundant occurrence in many archaeological sites and the absence of evidence for local on-site production shows that these tools derived from elsewhere, but little was known for a long time about their sources.

The large dimensions of these tools are referring to large cores, where they have been detached from, which means that already, due to logistical reasons, their production close to the mines was imaginable.

Apart from a couple of small quarry sites, reported from the Negev and the Sinai, on which a very small number of cortex scraper blank cores have been discovered, which refers to a more domestic production of these tools <sup>4</sup>, no evidences for cortical scraper production sites were found west of the cortical Jordan River.

It was in 1998 when L. Quintero and Ph. Wilke discovered large mining sites in southeastern Jordan on the northern ridge of the Jafr Basin <sup>5</sup>. Additionally, S. Fujii found a similar mining site not too far away northwest of the Jafr sites at Qa' Abu Tulayha <sup>6</sup>.

In 2000 R. Eichmann and the author detected a mining site in northeastern Jordan in the greater area of the Wadi Ruwayshid, which was initially surveyed in 2005 <sup>7</sup> and extensively surveyed in 2010 <sup>8</sup> (**fig. 1**). Both mining regions (Jafr and Ruwayshid) are characterised by a number of large scale mines, where flint nodules have been extracted from outcropping flint layers, then broken into pieces, which again have been converted into large cores. From these cores the desired cortical flakes have been detached. These mining regions are the only ones known in all of SW Asia so far, where cortical tool production, was carried out in an industrial scale.

## GEOLOGICAL AND GEOMORPHOLOGICAL ASPECTS OF THE LOCATION OF THE SPECIFIC MINES AND QUARRIES

In both regions Eocene flint layers were exploited for obtaining the raw material, which is in both cases characterised by a fine texture, with almost no microfossils, and being mostly dark brown in colour <sup>9</sup>. The exploited flint layers are usually located on top of the elevations, which is especially the case in the greater Wadi Ruwayshid mining area (**fig. 2**).

2. SCHMIDT 1996, p. 87-88.

3. MÜLLER-NEUHOF 2000, p. 144, pl. 110.

4. ROSEN 1983, p. 80.

5. QUINTERO *et al.* 2002.

6. FUJII 2000; 2003.

7. MÜLLER-NEUHOF 2006.

8. MÜLLER-NEUHOF i.p. a this report has been already delivered to be published in the series *Studies in the History and Archaeology of Jordan (SHAJ)* Vol. 11. It is the publication of a paper presented on the 11<sup>th</sup> SHAJ conference (Paris 2010). This present contribution is in large part based on this SHAJ contribution. The 2010 survey was a component of the larger survey project “*Arid habitats in the 5<sup>th</sup> to the early 3<sup>rd</sup> millennium BC: mobile subsistence, communication and key resource use in the Northern Badia (NE-Jordan)*”, which has been in operation since the beginning of 2010 and is financially supported by the *Deutsche Forschungsgemeinschaft* (German Research Foundation) (Az: MU3075/1-1). Other participants on the Wadi Ruwayshid flint mine survey were Dipl.-Geogr. J. Krause (Freie Universität Berlin) and W. Esaid B. A. (Department of Antiquities of Jordan). Since 2011 the entire project is a CBRL affiliated project.

9. QUINTERO *et al.* 2002, p. 19.

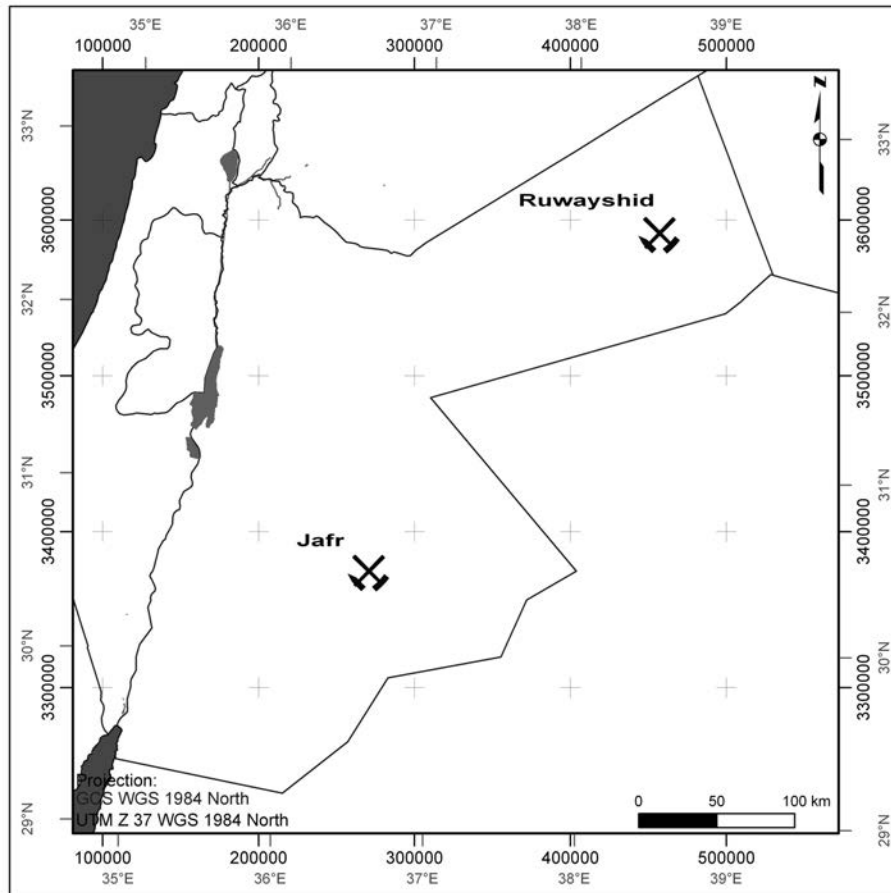


Figure 1. Location of the known large mining-regions Jafr and the greater Wadi Ruwayshid mining region (© DAI Orient-Abteilung, N. Marquandt, B. Müller-Neuhof).



Figure 2. Detail of an outcropping flint-layer (site RUW 5.10)  
(© DAI Orient-Abteilung, N. M., B. M.-N.).

Here the investigated mines are all located on top of the ridges of the western escarpment of the Risha limestone plateau, whose elevation rises in a southeastern direction. These locations are the ones that contain the sought-after outcropping flint layers (**fig. 3**). It has to be emphasized that in this region a number of different easily accessible flint outcrops at different altitudes are available. However, mining took place just in flint outcrops at an altitude between c. 780 and 815 m a.s.l. (**fig. 4**). All the other outcropping flint below and above the mentioned altitude span were not exploited<sup>10</sup>.

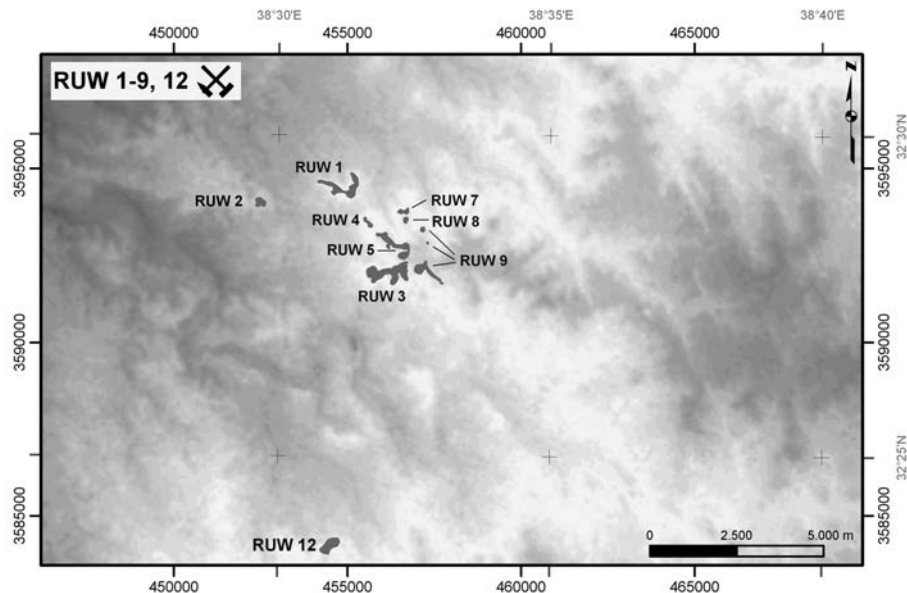


Figure 3. Illustration the siting of the investigated mines in the greater Wadi Ruwayshid mining region (© DAI Orient-Abteilung, N. M., B. M.-N.).

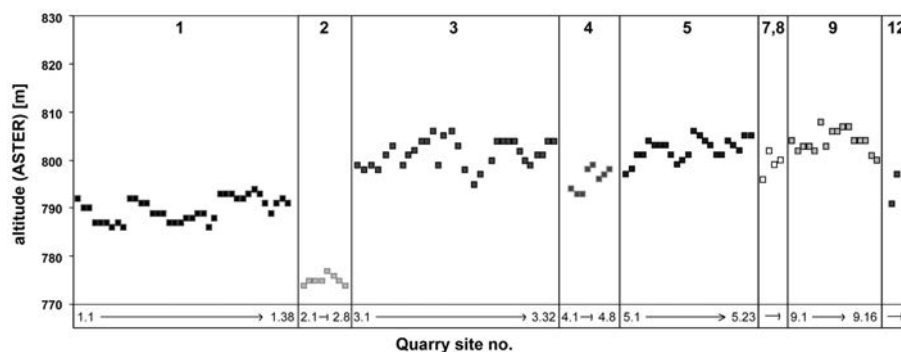


Figure 4. Dispersion of the altitudes of the identified mines in the greater Wadi Ruwayshid region (© DAI Orient-Abteilung, N. M., B. M.-N.).

10. One exception is the mining area RUW 2, whose altitude is below 780 m a.s.l. The fact that this lower lying flint layer was exploited can possibly be explained by a sinking process of this area due to tectonic events. This mining area is isolate in the adjacent plain west of the main mining region. However, the flint raw material of this area is similar to the exploited material on the other mining areas.

### AREAL EXTENT OF THE GREATER WADI RUWAYSHID MINING REGION ON THE RISHA PLATEAU

Because the exploitation of the specific flint layer was limited to a defined altitude range, the eastern and western border of the mining region could easily be identified, due to the rise (towards east) and decline (towards west) of the terrain. Additionally, the northern limit of the mining region was definable as well, by a change in the topography, from steep slopes in the mining area to a landscape characterised by shallower slopes north of the mining region, where no flint outcrops are visible due to ancient colluvial processes that have covered the slopes and possible flint outcrops.

The southern limit of the entire mining region has not yet been defined (**fig. 5**). The extension of mining sites towards the south is exemplified by the mining site RUW 12, which was visited on the last day of the survey season 2010 in the course of a random inspection. Here it became clear again that altitude and slope gradient are the major characteristics for identifying flint mines on the fringes of the Risha limestone plateau (**fig. 6**).

Taking these major characteristics into account, several more mining sites might exist along the fringes of the Risha limestone plateau towards south (**fig. 7**), and probably also in the territories of Saudi Arabia and on the eastern side of the Risha plateau in Iraq as well (**fig. 8**)<sup>11</sup>.

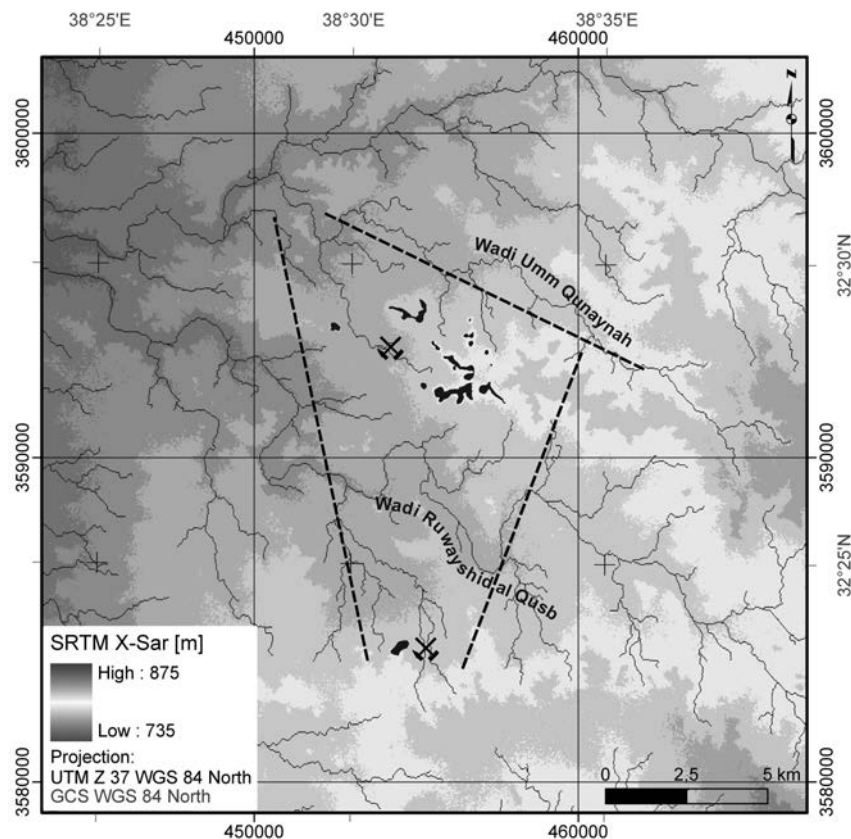


Figure 5. Identified extension of the greater Wadi Ruwayshid mining region and its northern, western and eastern limits (© DAI Orient-Abteilung, N. M., B. M.-N.).

11. In 2012 further large mines were discovered south of the region described here (MÜLLER-NEUHOF i. p. b).



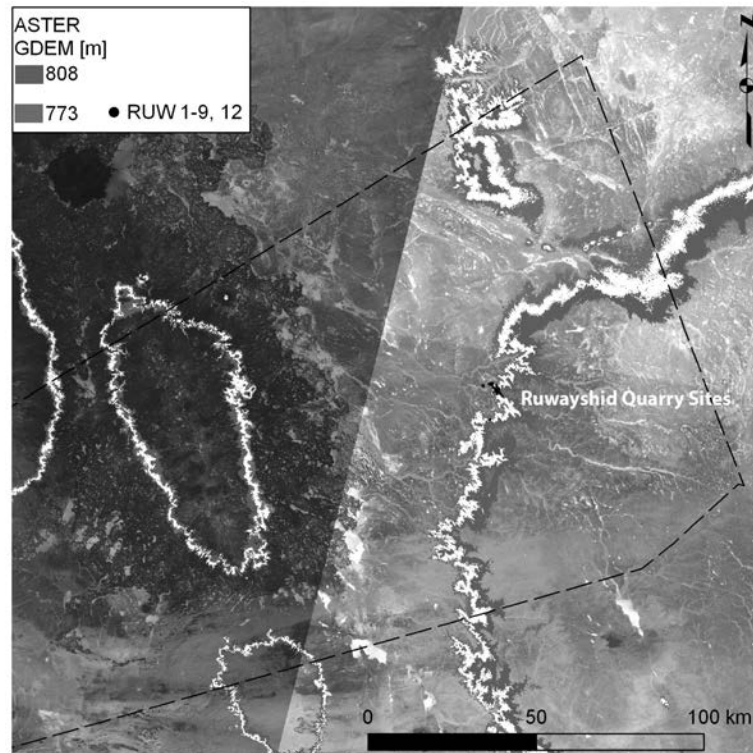


Figure 6. Elevation model of the western part of the Risha limestone plateau (covering the right lower corner of the image) with locations of the identified mines (© DAI Orient-Abteilung, N. M., B. M.-N.).

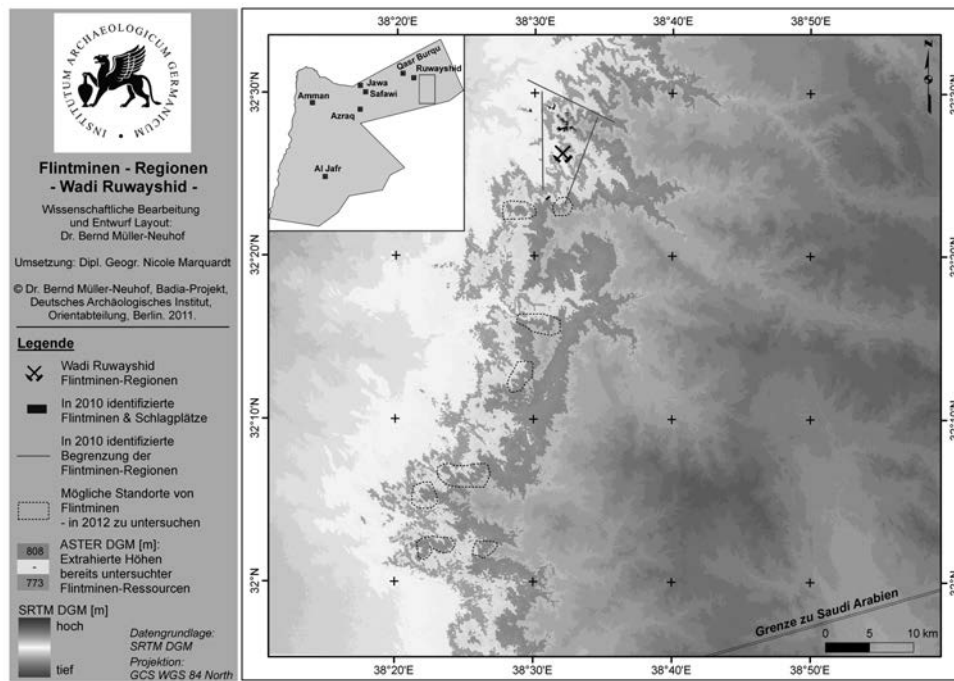


Figure 7. Localisation of possible other mining sites according to their altitudes and slope gradients south of the already identified mines, indicated by dotted lines (© DAI Orient-Abteilung, N. M., B. M.-N.).

### LOCATION OF MINES AND MINING METHODS

Mining took place along the fringes of the escarpment of the promontories, where the uppermost and desired flint cropped out from the elevations (**fig. 9**). Most of the mines stretch along these escarpments in a band with a width of c. 30 m, covered by broken limestone, nodule fragments, chunks, cores and debris of mining, primary production and blank production (see below, “*chaîne opératoire*”) (**fig. 10**).

Here the mining process started by removing the c. 20 cm thick limestone layer covering the flint on the ridges at the outcrops, followed by breaking the nodules out of the flint layer, and then finally the primary production process.

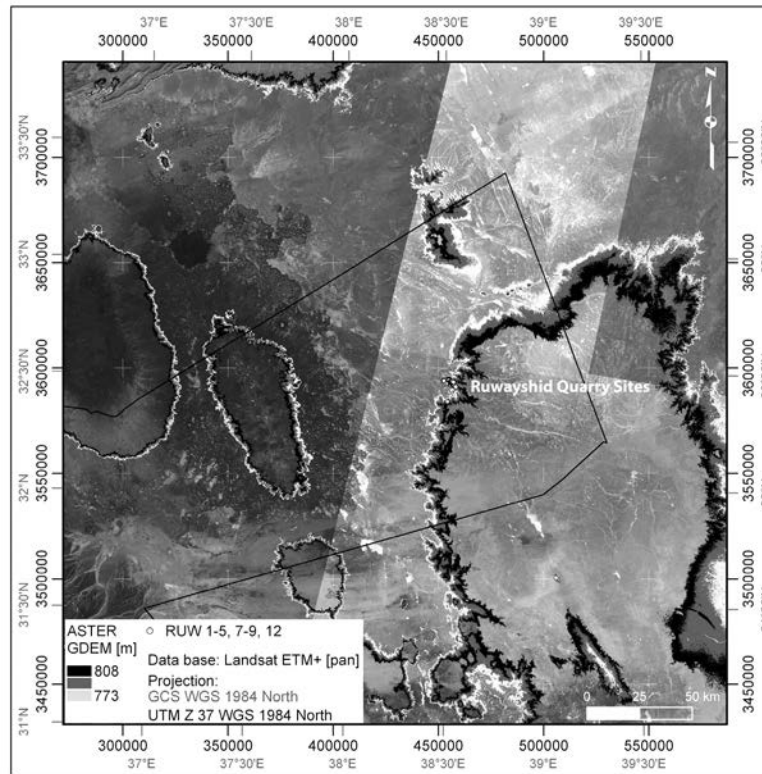


Figure 8. Elevation model of the entire Risha limestone plateau, whose expanse covers parts of the territories of today Jordan, Iraq and Saudi Arabia. Other possible mining regions may exist on parts of this plateau in Iraqi and Saudi Arabian territories, where narrow counter bands indicate steep slope gradients (© DAI Orient-Abteilung, N. M., B. M.-N.).



Figure 9. Natural flint outcrop (site RUW 3) below the uppermost limestone layer (© DAI Orient-Abteilung, N. M., B. M.-N.).



However, some mining sites extend up to 100 m inward from the escarpment along the surface of the plateau with dimensions of up to 2,500 m<sup>2</sup> (fig. 11), and they show the same spectrum of mining and production debris. Such a wide extension of the mining and production areas away from the fringes of the escarpments makes it unlikely that the material derives only from these fringes. Several heaps of limestone debris within these areas let us suppose that pit-mining, with post-exploitation refilling, as another mining method was applied here (fig. 12). Such a mining technology was observed by S. Fujii in mining site at Qa' Abu Tulayha in the Jafr region<sup>12</sup>. This possibility will be verified in a coming field season by small scale soundings. Interestingly, trench-mining, which was observed on some of the Jafr sites surveyed by Quintero et al.<sup>13</sup>, have not yet been detected in the Wadi Ruwayshid mining region.

#### THE “CHAÎNE OPÉRATOIRE” AND THE CORTEX TOOL BLANK PRODUCTION

The lithic artefacts on the mining sites and workshops comprise all steps of the “*chaîne opératoire*” of the primary production. Suitable chunks, deriving from intentionally fractured flint nodules (fig. 13), represent the first step of primary production after these nodules had been broken out of the flint layer. Large platform preparation spalls (fig. 14) and small platform preparation flakes reflect the preparation of platforms for the cortical tool blank detachment. From these platforms cortical tool blanks were detached by direct percussion. It was intended to produce blanks that were as large and as thin as possible, preferably of fan shaped design. This intention is documented by the presence of production waste, as indicated by broken cortical scraper blanks and rejects of blanks of improper size and thickness (fig. 15). Complete blanks of the intended quality have not been found, because these blanks would have been exported from these sites. However, indirectly the production of large and small cortical tool blanks is demonstrated by the respective negatives on

12. FUJII 2003, p. 210.

13. QUINTERO *et al.* 2002, p. 26.



Figure 10. Mining area (site RUW 3.5) with broken limestone on the fringe of the escarpment with remains of mining and blank production activities  
(© DAI Orient-Abteilung, N. M., B. M.-N.).



Figure 11. Large mining area (site RUW 3.18) extending inwards the top of the elevation  
(© DAI Orient-Abteilung, N. M., B. M.-N.).



Figure 12. Large mining area (site RUW 3.20) with heaps of limestone debris between the mined flint nodules and the blank production debris  
(© DAI Orient-Abteilung, N. M., B. M.-N.).



Figure 13. Flint chunk (© DAI Orient-Abteilung, N. M., B. M.-N.).



Figure 15. Broken and rejected cortical scraper blanks due to their size and thickness (© DAI Orient-Abteilung, N. M., B. M.-N.).



Figure 16. Cortical flake core (© DAI Orient-Abteilung, N. M., B. M.-N.).



Figure 14. Platform preparation spall (© DAI Orient-Abteilung, N. M., B. M.-N.).

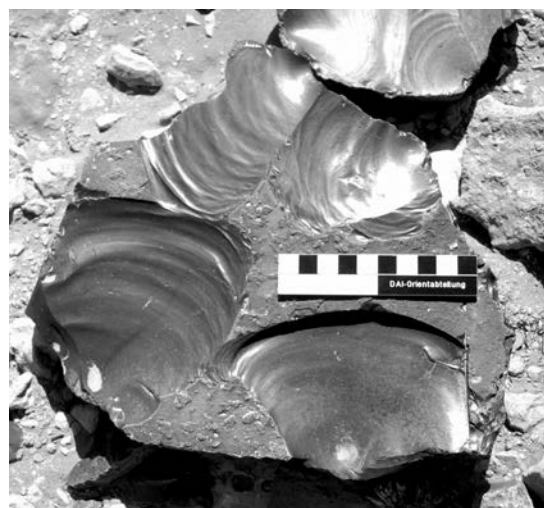


Figure 17. Cortical flake core with negatives of multiple flake detachments (© DAI Orient-Abteilung, N. M., B. M.-N.).



the cores (**fig. 16**), which also gives a clue that the task was to detach as many blanks as possible from one core, documented by several negatives on the cortical surfaces of the cores (**fig. 17**).

It can be assumed that hammerstones were used as tools for carrying out these objectives. Except for one broken small hammerstone, made out of flint wadi pebble, no hammerstones have been found yet on the surveys. I believe that such tools were of high value and were kept and carried always by their owners.

### THE PRODUCTION OUTPUT OF THE MINES

The cores covered with negatives of cortical flakes, intended to be used as tool-blanks, not only demonstrate the production of these flakes on these sites, they also enable us to assess the approximate production output of cortical tool blanks in this region with further implications referring to craft specialisation, trade contacts and even issues dealing with chronological placing.

During the 2010 survey several squares within three of the larger mining-sites were randomly chosen, for counting the negatives of the cortical tool blanks on the surfaces of the cores within these squares. Only cores lying directly on the surface were taken into account to collect these data. The number of negatives in these squares, which were characterised by a similar core density, was between 5 to 11 negatives per m<sup>2</sup>. Additional data collections were carried out on small workshop sites, close to small mines, with a very low core density and an average of c. 2 negatives per m<sup>2</sup>.

The entire size of the mining region surveyed thus far, containing the large cortical flake mining sites as well as smaller workshop sites, is about 112,000 m<sup>2</sup> or 11,2 ha. Taking the lowest mean average of 2 negatives per m<sup>2</sup>, the production output of the surveyed mining areas was at least c. 224,000 cortical scraper blanks. However, it can be assumed that the actual production output was much higher, probably between 500,000 and 750,000 tool blanks.

Even with these uncertainties it can be stated that the greater Wadi Ruwayshid region, in addition to the previously identified Jafr region, was the locus of some of the most intensive cortical scraper blank production areas in SW Asia. Such a large production output exceeds clearly the personal needs of the producers, who most probably were integral parts of the pastoral nomad context. It is clear that the major intent for producing these blanks was their export to regions where these blanks were very much needed. It can be stated, as in the case of the Jafr mines, that the mining activities on the Risha plateau in the greater Wadi Ruwayshid region supplied consumer regions, which probably were located far away in regions where such raw material was not obtainable, most likely in the west.

The large output raises the question about the manner of transport. Especially in case of the larger mining sites, characterised by a very intense production, large quantities of blanks can be expected, which were produced during one season and exported. Presumably beasts of burden were used for the transport, which was most probably the domesticated donkey<sup>14</sup>. Due to the circumstance that no other datable finds have been found on the survey, and since such cortical tools were produced from the Late Neolithic on<sup>15</sup>, the possible utilization of donkeys sets chronological limits, referring to the production activities in these mines.

Since the domesticated donkey existed in Southwest Asia from the beginning of the fourth millennium on, it can be assumed that the mining activities started earliest in that time and lasted probably until the beginning of the third millennium. Furthermore, it can be expected that the production of cortical tool blanks was carried out in the framework of an expanded pastoral nomadic economy, which means that pastoral groups were visiting this region on their annual pasture circle in spring. During the time of pasture, the blanks were produced and carried along on the journey back to settled regions in the

14. The same manner of transport is assumed for the Jafr mines (QUINTERO *et al.* 2002, p. 45). On the contrary see Fujii (2002, p. 219) who assumes a much lower output per year and therefore no involvement of donkeys in blank transport.

15. MOORE 1973.

summer. Such an assumption is supported by the lack of permanent water resources and absence of evidence for permanent settlements dating to this period in the area.

### CONCLUSION

The localisation of the only two known large mining regions in the eastern desert of Transjordan, where almost exclusively the very much needed cortical tool blanks were produced, reflects several aspects especially concerning the socioeconomic conditions in the entire region of SW-Asia in the late 5<sup>th</sup> to the early 3<sup>rd</sup> millennium.

First of all, taking into consideration that similar mining sites are really absent west of the Jordan River and also in the western parts of Transjordan, the location of these mines far away in the eastern deserts may primarily be explained by geological characteristics, particularly the presence of high quality Eocene flint raw material. This raw material met perfectly the requirements for cortical tools and was presumably not available in a comparable quality, quantity, or nodules of adequate size in more westerly located flint deposits, closer to permanent settled territories.

Thus it is highly likely that more comparable mining sites can be expected in the eastern desert of Transjordan and adjacent regions in northwestern Saudi Arabia, possibly also eastern Syria and at least on the eastern rim of the Risha plateau, which is located in western Iraq (see **fig. 8**).

The circumstance that such prime raw material resources, located in (at first glance) very peripherally situated territories, which are in addition characterised by difficult life conditions, i.e., due to the lack of permanent available water resources, have been intensively exploited in an almost “industrial” complexity, should prompt us to rethink our current impression in the geographical but also socioeconomic sense of such regions, as “peripherally” situated territories, which were at most occasionally visited by some pastoralists during the pasture seasons.

It is instead highly probable, that these regions were components of wide interregional socioeconomic networks, being territories in which intensive transhumant pastoralism, large scale mineral raw material exploitation and partly even interregional transport (trade) occurred. Animal products and the much needed cortical tool blanks were such items produced here and traded over large distances.

It is the challenge of future research in these arid regions to verify such an assumption by locating further mining sites where such cortical tool blanks were produced, and in developing and implementing methods for the geochemical characterisation of the respective deposits and consequently applying provenance analysis of cortical tools discovered in settlements in the west, far away from these sources.

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